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(56) Documents Cited

**EP 0867693 A1**

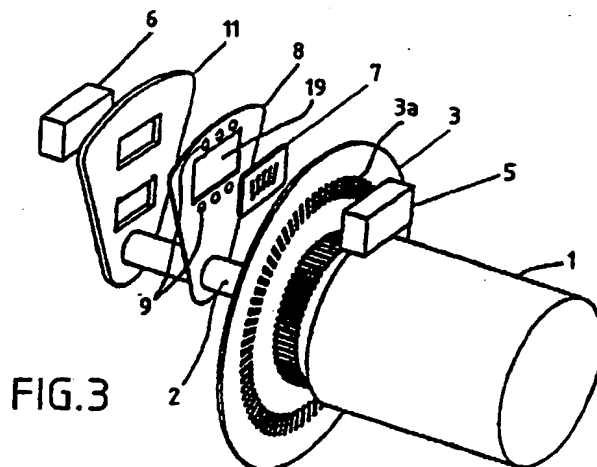
(58) Field of Search

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INT CL<sup>7</sup> **G01B 11/00 , G01D 5/347**  
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(54) Abstract Title

**Device for positioning machine parts moving on a straight or circular path**

(57) A device for position a machine part 1 is moved by an actuator and a control circuit in a straight or circular path inside a housing. A timing disk 3 or timing ruler is used as a reference point for the positioning, wherein the timing disk 3 or timing ruler is arranged in the path of a beam of between a light source 6 and a sensor unit 5. A beam mask 7 made of a film material is disposed between the light source 6 and the timing disk 3 or timing ruler, and a positioning and mounting plane for registration with a base plate 11 are provided. Also provided are guide means for positioning the beam mask 7 inside the housing in front of the light source.



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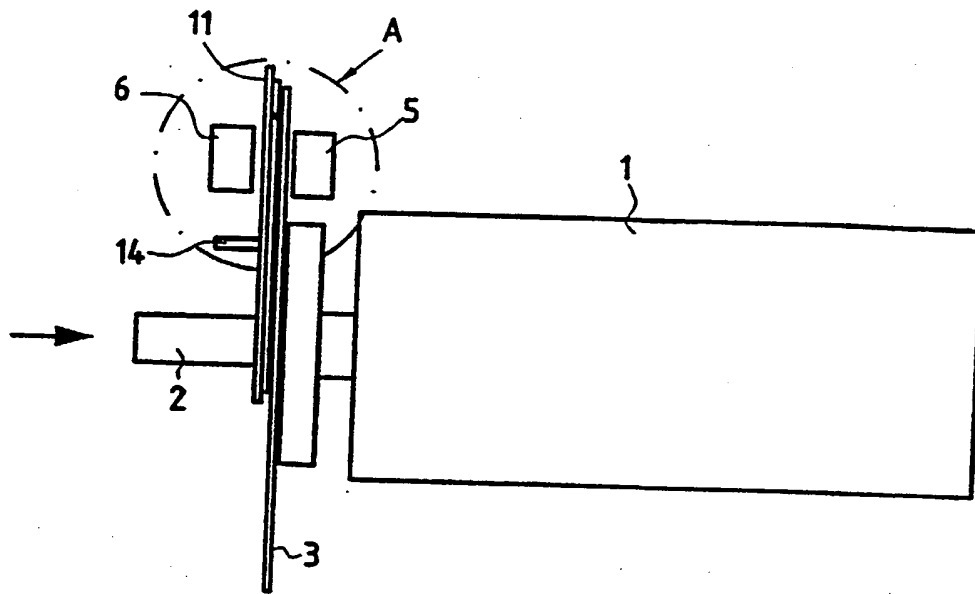


FIG. 1

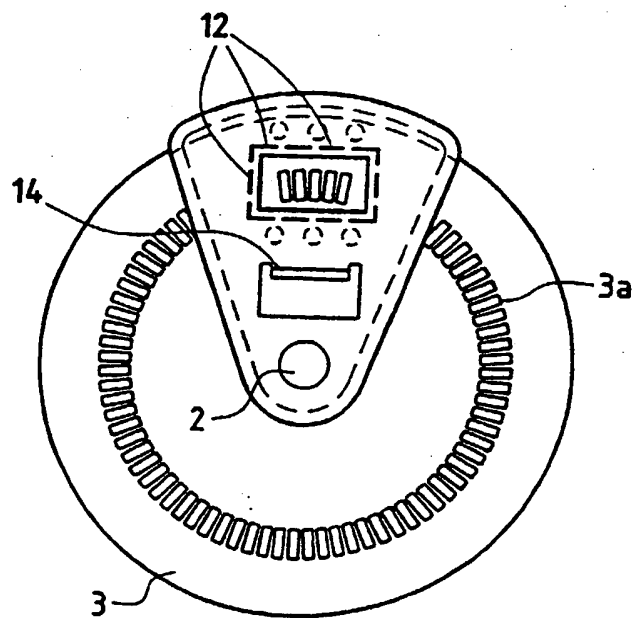


FIG. 2

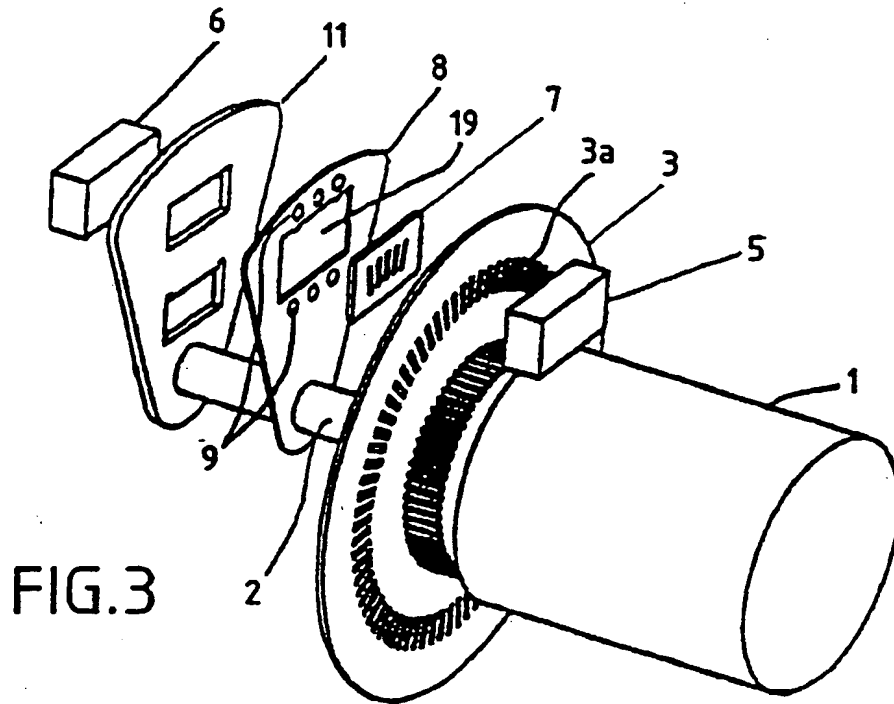


FIG. 3

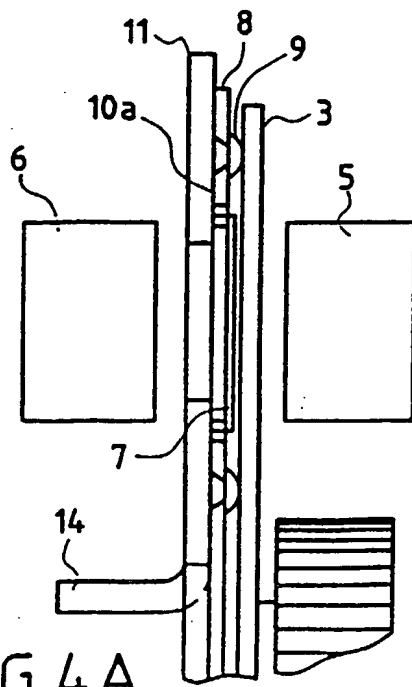


FIG. 4A

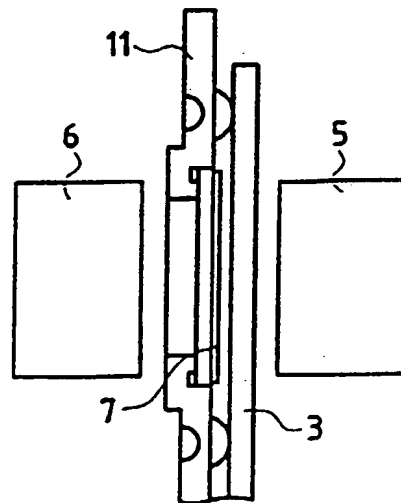


FIG. 4B

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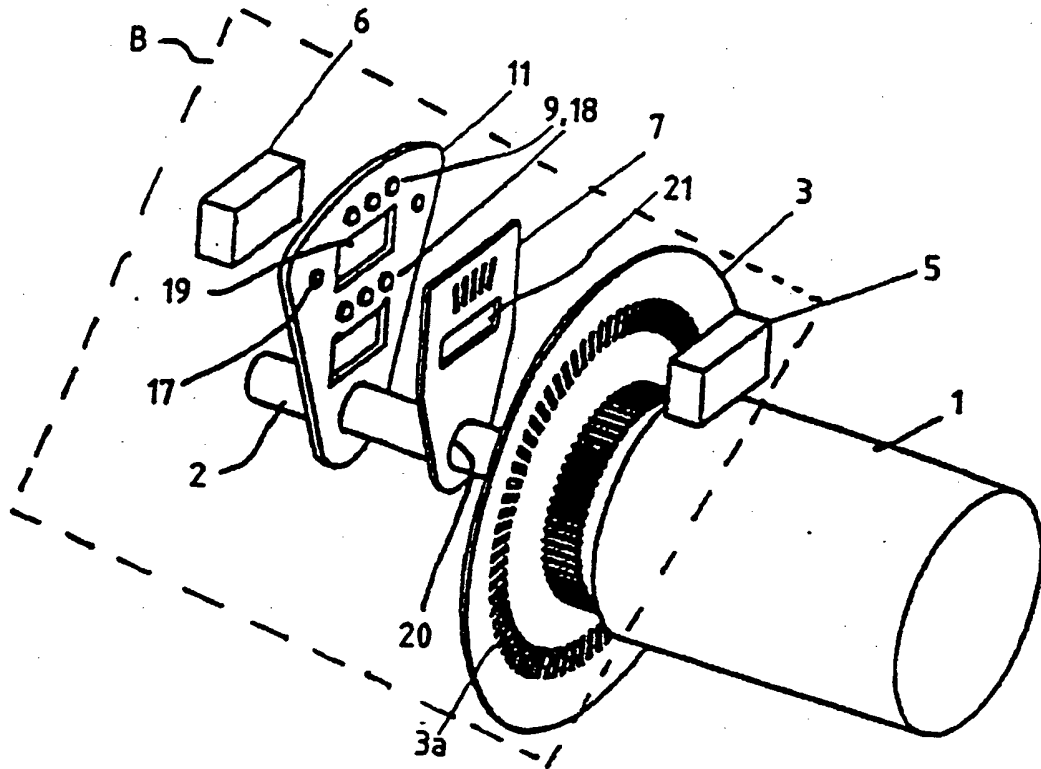


FIG. 5

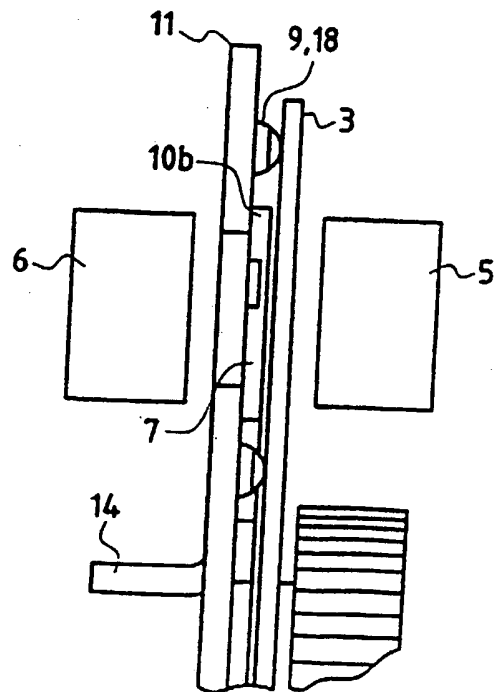


FIG. 6

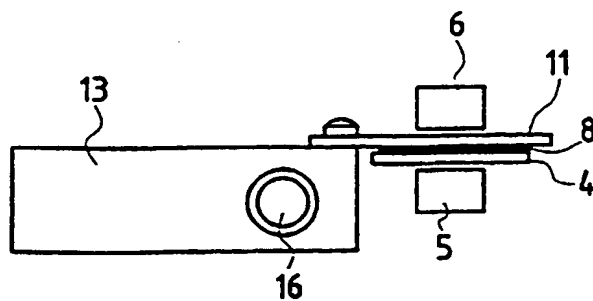


FIG. 7

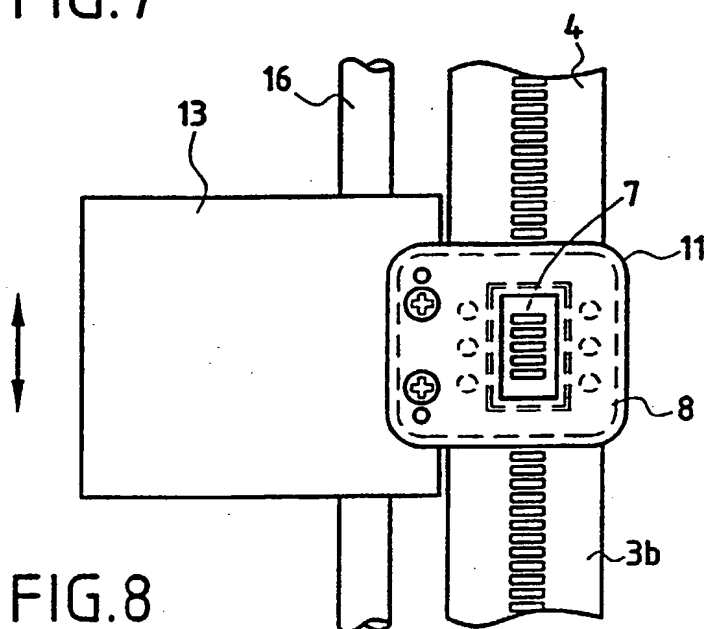


FIG. 8

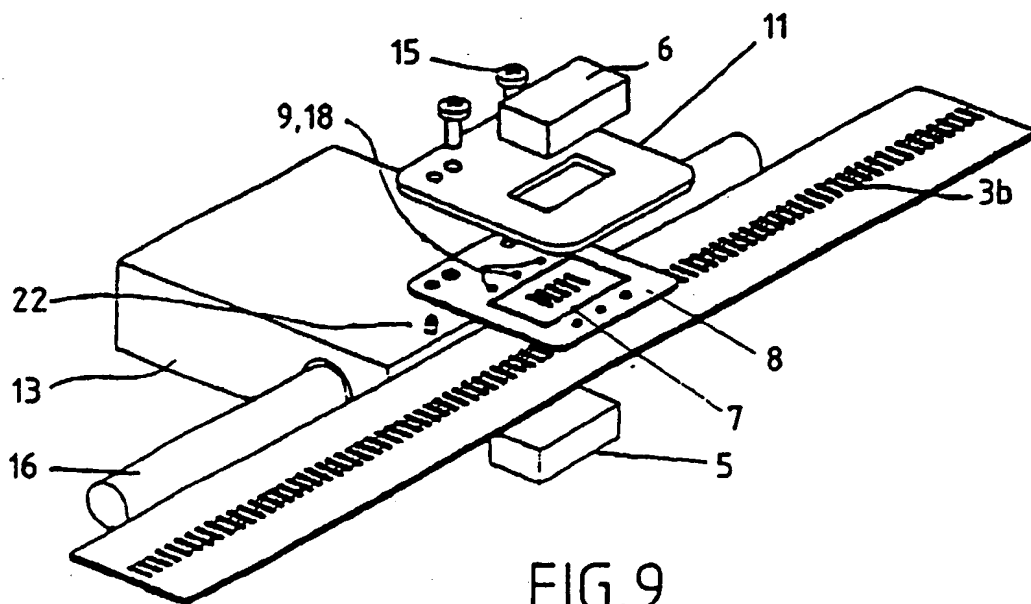


FIG. 9

**DEVICE FOR POSITIONING MACHINE PARTS MOVING ON A  
STRAIGHT OR CIRCULAR PATH**

**Description**

5

The invention relates to a device for positioning a machine part which is moved by an actuator and a control circuit in a straight or circular path inside a housing. A timing disk or a timing ruler is used as a reference point for positioning, wherein the timing disk or timing ruler is arranged  
10 in a beam path of a light source-receiver unit (LRU).

Devices of the aforescribed type are disclosed, for example, in US 4 266 125. With such devices, the light of the radiation source must exit absolutely parallel so as to eliminate parallax errors when the light  
15 passes through the timing disk or the timing ruler. The lens systems used for this purpose are complex and quite expensive, but also have the disadvantage of increasing the overall length of the positioning device. Moreover, the optical correction device also has to be accurately positioned which is frequently quite difficult due to the differing designs.

20

It is therefore an object of the present invention to develop a device for positioning machine parts that move on a straight or circular path which uses a light source-receiver unit, wherein the light source-receiver unit operates with light sources of arbitrary design while still producing light  
25 beams with sufficient parallelism without requiring complex optical correction devices while simultaneously decreasing the overall length along the optical axis. This object can be achieved by a beam mask made of a film material which is disposed between a light source and the timing disk or the timing ruler, respectively, and there are provided spacer  
30 elements facing the timing disk and timing ruler, respectively, and a

positioning and mounting plane for registration with a base plate, and guide means are provided for positioning the beam mask inside the housing in front of the light source.

- 5 The solution is based on a mask in the form of a film segment, wherein the mask is accurately positioned in the beam path of a light source-receiver unit by segregating and correlating the following functions:

10 The dimensions in two directions are correlated by the mask and the mask carrier (Fig.3) and by the mask (Fig.5), respectively, e.g., alignment in the film plane (2 axes).

The third direction is defined through the attachment (e.g., with an adhesive) of the mask on the base plate. The base plate also provides the  
15 stability of the system.

The correlation of the dimensions of the mask with those of the timing disk is provided by spacer elements, (e.g., embossed spacers, such as projections or ribs) on the mask carrier (Fig.4a) and on the base plate  
20 (Fig.6), respectively. According to a preferred embodiment the beam mask disposed between the light source and the timing disk or the timing ruler is positioned in the beam path of the light source in a mask carrier having a window, wherein the mask carrier comprises, on one hand, spacer elements, facing the timing disk or the timing ruler and, on the  
25 other hand, a positioning and mounting plane for registration with a base plate. A further embodiment is characterized in that the beam mask is formed in such a way that its position on the drive axis and towards the base plate can be adjusted via guide surfaces. Preferably the plate holders position the mask in the longitudinal and transverse direction of a plane  
30 parallel to the plane of the mask carrier or to the base plate and the mask

is pressed against the base plate and thereby fixed in the plane of the base plate. It is proposed that the mask carrier is made of a metallic material, the spacers comprise projections or ribs embossed in the mask carrier, the positioning and mounting plane comprises orientation marks for adhesive or laser weld joints, the base plate is made of a torsion-resistant material, in particular of a metal, and the mechanical rigidity is sufficient for an oscillation-free attachment to a moveable carriage, wherein the base plate together with the mask carrier protrude over the carriage and the spacer elements are arranged in the region of the window opening of the mask carrier, and are closely spaced thereto.

The invention will be described in greater detail hereinafter with reference to several embodiments. It is shown in:

- 15 Fig.1 a side view of a device according to the invention for positioning rotating machine parts;
- Fig.2 a frontal view in the direction of the arrow according to Fig.1;
- 20 Fig.3 an exploded view of the arrangement of Fig.1;
- Figs.4a,4b an enlarged view of two alternative spacers as indicated by the section A of Fig.1;
- 25 Fig.5 an exploded view of an alternative embodiment of the arrangement of the beam mask according to Fig.3;
- Fig.6 a partial cross-section of a detail B of Fig.5;
- 30



Fig.7 a side view of a device according to the invention for positioning machine parts moving along a straight path;

Fig.8 a top view of a device according to the invention of Fig.7;  
5 and

Fig.9 a perspective exploded view according to Fig.8.

The solution provided by the invention is based on a mask in the form of a  
10 film segment which is accurately positioned along all axes with respect to a timing disk disposed in the beam path of a light source. The solution is implemented by separating the functions and the association of these functions with different components.

15 The positioning device is composed of a timing disk, a mask carrier, a mask and a base plate and mounted in the beam path between the light source and the receiver. To this end, the timing disk is mounted on the rotating printing roller, whereas the base plate with the mask carrier and the mask is supported on the axis of the printing roller and secured  
20 against rotation on the frame. The base plate with the mask carrier and the mask is secured in such a way that a very narrow gap is formed between the timing disk and the mask. For this purpose, spacer elements are provided on the mask carrier which maintain the predetermined spacing when the mask carrier makes contact with or slides on the timing  
25 disk.

The base plate and the mask carrier are rigidly connected with each other (for example, with an adhesive). The mask receptacle is supported on the axis of the printing roller and provides through the corresponding mask  
30 window dimensional registration between the mask and the timing disk.

The base plate operates as a contact surface and attachment surface for the mask in the mask window and provides the stability of the system as well as the attachment to the frame.

- 5 The system is attached to the frame after the base plate together with the mask carrier and the mask have been pushed onto the axis of the printing roller and the predetermined spacing (contact between the spacer projections and the timing disk) has been established, which is described in the following:

10

1. The timing disk is secured on the rotating element (printing roller),
2. The base plate and the mask carrier are aligned and joined with one another (for example, with an adhesive),

15

3. The mask and the mask carrier are aligned and the mask is attached to the base plate (for example, with an adhesive),

20

4. The base plate with the mask carrier and the mask are pushed onto the axis of the printing roller, until the spacer elements (e.g., the projections or ribs) make contact with or slide against the timing disk,

5. In this position, the base plate with the mask carrier and the mask are secured to the frame.

25

The rotating machine part of Fig.1 is, for example, a printing roller 1 (in partial view) which has a timing disk 3 disposed on the drive axis 2.

30 Markings 3a which are located in the beam path of a light source-receiver unit 5, 6 are arranged on the side of the timing disk 3 - in the region of

the outer circumference. The light source is selected to match the respective sensor type.

The receiver 5 is attached on one side of the timing disk 3, whereas a radiation source, for example the light source 6, is attached on a housing (not shown) on the other side of the timing disk 3. A beam mask 7 on a mask carrier 8 is positioned in the beam path between the timing disk 3 and the light source 6, wherein the beam mask can be oriented along several 3-dimensional axes. A mounting plane (10a in Fig.4a, 10b in Fig.6) adapted for attachment to the base plate 11 is provided on the backside of the mask carrier 8 (as seen from the printing roller 1).

Referring now to Fig.5, according to an alternative embodiment of the device according to the invention for positioning machine parts moving on a straight or circular path, the mask carrier 8 can also be omitted, with the base plate and the beam mask 7 now assuming the respective functions of the mask carrier. As seen in Fig.5, the base plate 11 has spacer elements in the form of spacers 9, with the beam mask 7 having the size of the mask carrier, so that the beam mask 7 can be positioned on the drive axis 2 with the help of a corresponding bore and a guide plane 20.

20

The alternative embodiment is illustrated more clearly in Fig.6 which shows a partial cross-section of the detail B of Fig.5. It can be seen that spacer elements in the form of spacers 9 are provided between the base plate 11 and the timing disk 3 for accurately positioning the two components. The beam mask 7 is attached directly to the base plate 11 through an adherent surface 10b. A limit stop 14 provides the correct spacing relative to the housing of the positioning device according to the invention (not shown).

25

As mentioned above, the device of the invention can not only be used to accurately position rotating machine parts, but also machine parts moving on a straight path. This is illustrated in Figs. 7 to 9, wherein identical parts have identical reference numerals. The mask carrier 8 and the base plate 11 as well as the timing ruler 4, which is to be scanned in the direction of the arrow, are positioned between a receiver 5 and a light source 6.

The mask carrier 8 with the beam mask 7 is mounted on a carriage 13 provided with guide pins 22. Thereafter, the base plate 11 is placed on the mask carrier 8 and attached to the carriage 13 with screws 15. When the carriage 13 moves along the carriage guides 16, the markings 3b traverse the beam path of the light source-receiver unit 5, 6 and can be counted, thereby determining the position of the carriage 13.

The mask carrier 8 can essentially be made of any torsion-resistant material. Preferably, a metallic material is used which can be machined with the required precision.

Spacer elements 18 (for example, embossed spacers such as projections or ribs) disposed on the mask carrier 8 or on the base plate 11 provide the dimensional registration of the mask relative to the timing ruler.

The positioning or attachment planes 10a, 10b located on the mask carrier 8 or the beam mask 7 can have orientation marks 17 for adhesive or laser weld joints. Advantageously, the spacers 9 are arranged circumferentially about the window opening 19 of the mask carrier 8. This arrangement helps to maintain the exact spacing between the beam mask 7 and the timing disk or the timing ruler, respectively.

With the embodiment illustrated in Fig.5, the spacers 9, 18 can be pressed through a window opening 21 against the timing disk 3. In this way, the spacing with respect to the base plate 11 can be accurately adjusted.

**DEVICE FOR POSITIONING MACHINE PARTS MOVING ON A  
STRAIGHT OR CIRCULAR PATH**

**List of reference numerals:**

|    |        |                                  |
|----|--------|----------------------------------|
| 5  |        |                                  |
|    | 1      | printing roller                  |
|    | 2      | drive axis                       |
|    | 3      | timing disk                      |
|    | 3a, b  | markings                         |
| 10 | 4      | timing ruler                     |
|    | 5      | receiver                         |
|    | 6      | light source                     |
|    | 7      | beam mask                        |
|    | 8      | mask carrier                     |
| 15 | 9      | spacer                           |
|    | 10a, b | positioning and attachment plane |
|    | 11     | base plate                       |
|    | 12     | plate holder                     |
|    | 13     | carriage                         |
| 20 | 14     | limit stop                       |
|    | 15     | screw                            |
|    | 16     | carriage guides                  |
|    | 17     | orientation marks                |
|    | 18     | spacer elements                  |
| 25 | 19, 21 | window opening                   |
|    | 20     | guide planes                     |
|    | 22     | guide pin                        |

## CLAIMS

1. Device for positioning a machine part which is moved by an actuator and a control circuit in a straight or circular path inside a housing, wherein a timing disk or a timing ruler is used as a reference point for positioning, with the timing disk or timing ruler arranged in a beam path of a light source-sensor unit, and wherein a beam mask made of a film material is disposed between a light source and the timing disk or the timing ruler, respectively, and that there are provided spacer elements facing the timing disk and timing ruler, respectively, and a positioning and mounting plane for registration with a base plate, and guide means are provided for positioning the beam mask inside the housing in front of the light source.
2. The device according to claim 1, wherein the beam mask disposed between the light source and the timing disk or the timing ruler is positioned in the beam path of the light source in a mask carrier having a window, wherein the mask carrier comprises, on one hand, spacer elements facing the timing disk or the timing ruler and, on the other hand, a positioning and mounting plane for registration with a base plate.
3. The device according to claim 1, wherein the beam mask is formed in such a way that its position on the drive axis and towards the base plate can be adjusted via guide surfaces.
4. The device according to one of the preceding claims, wherein the plate holders position the mask in the longitudinal and transverse direction of a plane parallel to the plane of the mask carrier or to the base plate.

5. The device according to one of the preceding claims, wherein the mask is pressed against the base plate and thereby fixed in the plane of the base plate.
- 5 6. The device according to one of the preceding claims, wherein the mask carrier is made of a metallic material.
7. The device according to one of the preceding claims, wherein the spacers comprise projections or ribs embossed in the mask carrier.
- 10 8. The device according to one of the preceding claims, wherein the positioning and mounting plane comprises orientation marks for adhesive or laser weld joints.
- 15 9. The device according to one of the preceding claims, wherein the base plate is made of a torsion-resistant material, in particular of a metal, and the mechanical rigidity is sufficient for an oscillation-free attachment to a moveable carriage, wherein the base plate together with the mask carrier protrude over the carriage.
- 20 10. The device according to one of the preceding claims, wherein the spacer elements are arranged in the region of the window opening of the mask carrier, and are closely spaced thereto.
- 25 11. A device for positioning a machine part substantially as hereinbefore described with reference to the accompanying drawings.





**Application No:** GB 0108428.4  
**Claims searched:** 1 to 11

**Examiner:** Jane Croucher  
**Date of search:** 31 January 2002

## Patents Act 1977 Search Report under Section 17

### Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.T): G1A (AEAL, AEAX, ARM)

Int Cl (Ed.7): G01B (11/00), G01D (5/347)

Other: Online: WPI, PAJ, EPODOC

### Documents considered to be relevant:

| Category | Identity of document and relevant passage     | Relevant to claims |
|----------|---|--------------------|
| A        | EP 0867693 A1 KOYO SEIKO (see whole document) | -                  |

|   |   |   |  |
|---|---|---|--|
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